CONSTRUCTION QUALITY ASSURANCE PLAN – MODIFICATION NO. 1

JORGENSEN FORGE EARLY ACTION REMOVAL ACTION

Prepared for

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Prepared by

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LIST OF ACRONYMS AND ABBREVIATIONS

AM	Action Memorandum
BODR	Basis of Design Report
cm	centimeters
CQAP	Construction Quality Assurance Plan
DGPS	differential global positioning system
DMU	dredge management unit
EAA	Early Action Area
EMJ	Earle M. Jorgensen Company
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GAC	granular activated carbon
HSP	Health and Safety Plan
Mg/kg-OC	milligrams per kilogram normalized for organic content
NTCRA	non-time-critical removal action
OMMP	Operations, Monitoring, and Maintenance Plan
PCB	polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
RAB	removal action boundary
RvAL	removal action levels
SAP	Sampling and Analysis Plan

1 INTRODUCTION AND BACKGROUND

This Construction Quality Assurance Plan (CQAP) Modification No. 1 has been prepared as a modification to the CQAP (Appendix D of the Basis of Design Report [BODR; Anchor QEA 2013a]) prepared by Anchor QEA (Anchor QEA 2013b) and approved in writing by the U.S. Environmental Protection Agency (EPA) on August 16, 2013. This CQAP Modification No. 1 provides the scope and work plan for collection and analysis of sediment samples from the post-dredge, pre-backfill sediment "z-layer" required by the EPA in its March 23, 2015 letter regarding "EPA Required Modifications to Appendix D, Construction Quality Assurance Plan, and Appendix F, Operations, Monitoring and Maintenance Plan, of Basis of Design Report for Jorgensen Forge Early Action Area" (EPA March 23, 2015 Letter; EPA 2015). EPA requires modification to the CQAP to further characterize the nature and extent of chemical concentrations in sediments beneath the clean backfill material. As discussed more fully below, Earle M. Jorgensen Company (EMJ) will perform the following activities as part of the CQAP Modification No. 1:

- Collect samples co-located to the degree practicable with the seven z-layer sample locations used during the non-time-critical removal action (NTCRA) that EMJ performed in summer 2014;
- Collect sample cores of sediment ranging from the 0 to -1, -1 to -2, and -2 to -3 foot intervals below the as-built NTCRA dredge elevations; and
- Analyze each of the sample core intervals for all contaminants of concern identified in the October 2011 Action Memorandum (AM; EPA 2011), and conventional parameters.

EMJ performed the NTCRA between July and September 13, 2014, in accordance with the EPA-approved Final Design documents (Appendices G and H of the BODR; Anchor QEA 2013c, 2013d) required by the AM (EPA 2011). Pursuant to Section 5.3.1.1 of the CQAP, six subsurface (0- to 1-foot) sediment samples were collected within the in-water portion of the removal action boundary (RAB) using a surface grab sampler to characterize the post-dredge, pre-backfill sediment "z-layer" chemical concentrations. An additional z-layer sample (0 to 1 foot) was collected in the former "cofferdam area" for the same purpose. These z-layer sediment samples were collected to characterize the concentrations of polychlorinated biphenyls (PCBs) and metals at the post-dredge surface, including the chemical

concentrations of residuals generated during dredging. Generated residuals are defined as "contaminated post-dredging surface sediments that are suspended by the dredging process and are subsequently re-deposited on the bottom of the water body" in "The Four Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk" document developed by U.S. Army Corps of Engineers and the Engineering Research and Development Center (USACE/ERDC 2008). USACE/ERDC (2008) further states that "No removal technology can remove every particle of contaminated sediment, and field results to date for completed environmental dredging pilots and full-scale projects suggest that post-dredging residual contamination levels have often not met desired cleanup levels." The PCB concentrations detected in each of the seven z-layer sediment samples collected (Figure 1) exceeded the total PCB removal action level (RvAL) of 12 milligrams per kilogram normalized for organic content (mg/kg-OC). Concentrations of metals above the RvALs were not detected.

EPA now requires a modification to the CQAP to collect and analyze additional post dredge, pre-backfill z-layer surface and subsurface sediment samples to adequately assess compliance with the Jorgensen Forge Early Action Area (EAA) RvALs. The activities described in this document will follow all relevant portions of the EPA-approved Sampling and Analysis Plan (SAP; Appendix I to the BODR; Anchor QEA 2013e), consisting of the Quality Assurance Project Plan (QAPP; Attachment 1 to the SAP) and the Field Sampling Plan (FSP; Attachment 2 to the SAP) and Health and Safety Plan (HSP; Attachment K to the BODR; Anchor QEA 2013f) unless otherwise detailed.

1.1 Purpose

This CQAP Modification No. 1 provides the scope and work plan to collect and analyze sediment samples to characterize the nature and extent of contamination in sediments beneath the existing backfill as required by the EPA March 23, 2015 Letter. EPA is requiring re-sampling each of the seven z-layer sediment locations, including the former cofferdam, for analysis of all Jorgensen Forge EAA contaminants of concern in sediments at the post-dredge, pre-backfill z-layer surface and at identified intervals underneath the post-dredge, pre-backfill z-layer surface in accordance with the requirements of the Puget Sound Estuary Program protocols, as appropriate.

This CQAP Modification No. 1 provides the scope and work plan to do the following:

- Collect sediment sample cores from the 0 to -1-foot, -1 to -2-foot, and -2 to -3-foot intervals below the post-dredge, pre-backfill z-layer surface at the seven z-layer sample stations used during the 2014 NTCRA construction work;
- Analyze the sediment samples in the 0 to -1-foot and -1 to -2-foot intervals for all contaminants of concern identified in the Action Memorandum (EPA 2011) and conventional parameters. Archive the sediment samples in the -2 to -3-foot interval.;
- Modify the SAP (Anchor QEA 2013e), including the FSP (Attachment 2 to the SAP) and QAPP (Attachment 1 to the SAP), and the HSP (Anchor QEA 2013f) as necessary to provide the sampling methods not included in the EPA-approved CQAP; and
- Evaluate data and address protectiveness of the backfill material by doing the following:
  - Characterizing the nature and extent of concentrations of contaminants of concern in sediments in the 0 to -1-foot and -1 to -2-foot sediment intervals below the post-dredge, pre-backfill z-layer surface (the -2 to -3-foot interval will be archived)
  - Chemical modeling to assess whether the sediments below the backfill material that may have chemical concentrations above the RvALs are protective of human health and the environment at the applicable points of compliance and exposure media
  - Assessing the physical isolation of sediments with concentrations of total PCBs or metals above the RvALs from aquatic organisms
  - Assessing backfill stability
  - Considering operational actions needed to assure backfill stability

These activities will also support EMJ's separate evaluations of nearshore groundwater quality and the chemical nature of the backfill material presented in the Operations, Monitoring, and Maintenance Plan (OMMP) Addendums No. 1 and No. 2 (Farallon in process, Anchor QEA 2015).

1.2 Background

Z-layer surface sediment samples were collected (0 to -1-foot) during the NTCRA in each dredge management unit (DMU) using a grab sampler upon completion of dredging in each DMU. Each sediment sample was analyzed for total solids, grain size, total PCBs, and metals.

In accordance with EPA requirements, each z-layer sediment sample was co-located with a pre-design characterization core location so that sediment samples collected from the z-layer were from the same depth intervals as the pre-construction sediment samples documenting total PCB concentrations below the RvAL. The z-layer sediment samples consisted of a variable surface layer (thickness ranging from 1 to 5 inches thick) of loose, wet silt to sandy silt. The sediments underlying the z-layer were described as sand to silty sand consistent with the pre-design characterization of sediments in the core logs. The physical description of the z-layer sediments did not match the physical description of the co-located pre-design characterization core log at the same depth, indicating that the z-layer samples likely represent deposited dredge residuals. The physical description of the sediment underlying the z-layer is consistent with the physical description of the co-located pre-design characterization core log and likely represent the in situ post-dredge surface.

The analytical results of sediment samples collected from the z-layer detected concentrations of metals below the metals RvALs. The dry weight total PCB concentrations ranged from 198 to 1,560 micrograms per kilogram. The organic carbon-normalized total PCB concentrations ranged from 23.5 to 167.7 mg/kg-OC in the six sediment samples collected from the z-layer in the DMUs and 13,600 mg/kg-OC in the sediment sample collected from the coffer dam area proximate to the historic 12- and 24-inch stormwater outfalls, which exceed the RvAL of 12 mg/kg-OC. These results will be further evaluated after implementation of the scope of work in this CQAP Modification No. 1 (see Section 4).

2 POST CONSTRUCTION Z-LAYER SEDIMENT SAMPLING

In accordance with the requirements identified in the EPA March 23, 2015 Letter, EMJ will collect post-construction subsurface sediment samples at 0 to -1-foot, -1 to -2-foot, and -2 to -3-foot intervals below the existing backfill in each DMU co-located with the seven z-layer sample stations used during the NTCRA. This sampling will consist of coring through between approximately 2 and 17 feet of placed backfill material to access the post-dredge, pre-backfill surface and the required depth intervals below the post-dredge surface. At two stations, PDS-1 and PDS-5, this will also consist of coring through armoring riprap material that was placed as part of the NTCRA shoreline containment.

The sampling will be conducted using sonic drilling. The remainder of this section details the sampling objectives, stations, depths, positioning controls, and sampling and processing methods.

2.1 Sampling Objective

The objective of the post-construction z-layer sampling is to further define the chemical and physical characteristics of the sediment at the 0 to -1-foot and -1 to -2-foot intervals below the post-dredge, pre-backfill surface. The analytical results will be used to further characterize the nature and extent of contamination, if any, that may remain at and below the post-dredge, pre-backfill surface and to determine whether the backfill is protective of human health and the environment at the applicable points of compliance and exposure media, as discussed in Section 4.

2.2 Sample Stations

The target sample stations are shown in Figure 2. As required by EPA, these stations are co-located to the degree practicable with the z-layer sample locations used during the NTCRA. Target coordinates for the sampling stations are provided in Table 1.

Table 1
Sample Station Coordinates

Station ID	Northing	Easting
PDS-1	195627.70	1275837.80
PDS-2	195512.60	1275857.20
PDS-3	195466.00	1275897.20
PDS-4	195309.80	1275866.70
PDS-5	195371.20	1275944.30
PDS-6	195180.00	1275925.70
PDS-7	195786.00	1275771.50

Notes:
Horizontal Datum: Washington State Plane, North American Datum 1983, North Zone, U.S. Survey Feet

2.3 Sampling Depths

The target sampling depths are based on the post-dredge, pre-backfill surface, which is defined as the point of contact between the placed clean shoreline containment filter material (for stations PDS-1 and PDS-5) or in-water backfill material and underlying undisturbed native material. This point of contact will be targeted using the post-backfill surface elevations compared to post-dredge, pre-backfill surface elevations (i.e., depth of backfill). These elevations are targets only because between the time that the post-dredge survey was conducted and the final layer of backfill material was placed, additional sediment could have moved into the RAB as a result of river dynamics and/or bank sloughing. The target depth for the interface between backfill or shoreline containment material and native material, as determined by the surveyed depth of placed material, is provided in Table 2 for each sample station.

The actual point of contact between the imported material and underlying sediments will be determined in the field based on visual observation. The shoreline containment filter material consists of a mixture of coarse to fine sand amended with 0.5% granular activated carbon (GAC; black colored material), and in-water backfill material consists of sand and gravel. Both of these imported material types are significantly different than the undisturbed native sediments described as sand to silty sand. The differences in physical characteristics

will be used in the field to identify the contact between the imported material and underlying native sediments.

Once the point of contact between the placed materials and underlying undisturbed native material is identified, samples will be collected at 0 to -1-foot, -1 to -2-foot, and -2 to -3-foot intervals below the point of contact.

Table 2
Depth of Backfill or Shoreline Containment Material Overlying Z-layer Sample Stations

Station ID	Post-Dredge Elevation (MLLW)	Post-Backfill Elevation (MLLW)	Depth of Backfill or Shoreline Containment (feet)
PDS-1[1]	-11.0	-5.6	5.4
PDS-2	-17.9	-8.5	9.4
PDS-3	-10.0	-3.6	6.4
PDS-4	-23.4	-21.5	1.9
PDS-5[1]	-8.0	-1.7	6.3
PDS-6	-18.5	-10.1	8.4
PDS-7	-11.8	5.7	17.5

Notes:
1 The z-layer sample location was overlain by a minimum (design thickness) of 1.5 feet of clean filter material amended with 0.5 percent granular activated carbon and 2.5 feet of riprap as part of the shoreline containment.
MLLW = mean lower low water

2.4 Horizontal Positioning and Vertical Control

Consistent with the SAP (Anchor QEA 2013e), horizontal positioning will be determined by an onboard differential global positioning system (DGPS) based on target coordinates shown in Table 1. The horizontal datum will be Washington State Plane North Zone, North American Datum 1983, U.S. Survey Feet.

Also consistent with the SAP (Anchor QEA 2013e), the vertical elevation of the mudline at each sediment sampling station will be measured using a depth sounder mounted on the sampling vessel. In addition, a weighted lead line tape will be used to confirm mudline depths at each sampling station. The mudline measurement, time, and predicted tidal

elevation at the time of sample collection will be recorded and used to determine the approximate sample elevations for each station. Actual tidal elevations will be determined after sample collection using the National Oceanic and Atmospheric Administration's tide gage located in Seattle, Washington (Station ID: 9447130) with offsets for the Lower Duwamish Waterway 8th Avenue station (Station ID: 9447129).

2.5 Sampling and Processing Methods

Sampling and processing methods will follow procedures in the SAP (Anchor QEA 2013e), unless otherwise stated below.

2.5.1 Sonic Drilling

Sediment samples will be collected using a sonic drill rig with a 4-, 6-, or 8-inch-diameter sampling barrel, based on conditions encountered during drilling. The sonic drill rig will be securely mounted to the barge for all sampling activities. Sediment borings will be advanced at the seven proposed locations (PDS-1 through PDS-7) using a rotosonic drill rig working from a shallow-draft (18-inch) barge. The drilling subcontractor will provide the sampling barge and equipment necessary for sampling operations. Continuous sediment samples will be obtained. The sonic drilling method is capable of providing relatively undisturbed sediment samples; however, some disturbance is unavoidable and will occur.

Drilling and sampling will be conducted in 5-foot increments to maintain depth control and isolate intervals of potentially lower sample recovery. These increments may need to be adjusted in the field based on actual conditions. The borings will start at the mudline, with a 5-foot-long (unless adjusted to account for site-specific conditions), 4-, 6-, or 8-inch inside diameter core tube. The core tube will be lowered though the water column to the mudline and driven into the sediment for the first sample interval, thereby coring the sediment. The core will be retrieved upon full penetration of the core tube interval or at refusal. The outer casing will be lowered over the sediment sampler to the bottom of the sample interval, and the sampler will be withdrawn to retrieve the sediment sample. The depth of core penetration will be measured and recorded, along with conditions and/or obstructions observed during drilling (e.g., difficult drilling conditions).

Before proceeding with the next sample interval, a lead line measurement will be taken in the cased sample hole to determine if heaving sands have reoccupied the casing and to verify the top depth and elevation of the next sample interval. If heaving sands are encountered and the casing is occupied by heave, the driller may not "blow out" this material using water or any other type of pressurized method, but must instead determine the length of the core tube that has been reoccupied and collect that material first before proceeding with the next sampling interval. Sediment collected in each core tube interval will be extruded into a plastic sleeve using low-frequency sonic vibrations to minimize sample disturbance. Sediment collected at elevations above the target interfaces shown in Table 2 may be discarded or archived for potential future analysis.

The sampler will then be advanced to the next sample interval. The core barrel will be rinsed clean of sediment with site water and decontaminated according to procedures detailed in Section 3.6 of the FSP (Attachment 2 to the SAP; Anchor QEA 2013e) before each use, including between station intervals and stations, to eliminate the possibility of cross contamination. After reaching the target depth and removal of the material for sampling, the sediment borings will be backfilled with bentonite grout as the casing is removed.

2.5.2 Processing

Sediment samples will be processed onboard the sampling vessel. Each drive length will be extruded into a plastic sleeve using low frequency sonic vibrations to minimize sample disturbance. For chemical and physical analyses, the plastic liner for each sampling interval will be cut lengthwise and opened for processing. Samples will be accepted and processed according to the procedures described in Sections 3.4.1.1 and 3.4.2 of the FSP (Attachment 2 to the SAP; Anchor QEA 2013e) with the following modifications:

- As described in Section 2.3, the target sampling depths are based on the post-dredge, pre-backfill surface, defined as the point of contact between the placed shoreline containment filter material or in-water backfill material and underlying undisturbed native material. This point of contact will be targeted using the post-backfill surface elevations compared to post-dredge surface elevations (i.e., depth of backfill) and will be determined in the field based on visual observation.

- Once the point of contact between the placed backfill material and native material is identified, sediment samples will be collected at 0 to -1-foot, -1 to -2-foot, and -2 to -3-foot (for archive) intervals below the interface.
- To the extent practicable, sediment samples will be collected from the center of the plastic sleeve, and the sleeve sidewalls will be avoided to minimize sampling material that could have been affected by drag-down.
- Each core will be described and documented on a standardized core log (Appendix A).

2.5.3 Chemical Analytical Parameters

The 0 to -1-foot and -1 to -2-foot samples at each station will be submitted for analysis. The -2 to -3-foot sediment sample intervals will be archived. If the results of the -1 to -2-foot sample interval show concentrations of a contaminant of concern above the RvAL for that contaminant, then the -2 to -3-foot sample interval for that sample location will be submitted for analysis.

Sediment samples will be analyzed for the following:

- Total PCBs
- Metals (arsenic, cadmium, chromium, copper, lead, mercury, zinc, and silver)
- Total organic carbon
- Total solids
- Grain size

Laboratory analytical methods will be consistent with the methods defined in the approved QAPP (Attachment 1 to the SAP). Wet and dry weight density (bulk density) is a new parameter requested by EPA in the EPA March 23, 2015 Letter. After discussing this requirement with the analytical laboratory and the project geotechnical engineers, collecting material for bulk density measurements would require drilling an additional boring and then modifying the drilling method to collect undisturbed samples. The feasibility of modifying the drilling method to accurately measure bulk density would need to be determined based on discussions with a driller in light of in-water conditions. Due to these questions on technical feasibility and the fact that bulk density does not appear necessary to achieve the

objectives stated in the EPA March 23, 2015 Letter, EMJ respectfully requests further discussion with EPA on this limited component of the requested sampling.

3 HEALTH AND SAFETY CONSIDERATIONS

The HSP (Anchor QEA 2013f) will be followed for sampling activities included in this CQAP Modification. The HSP includes a section (Section 12.1.3) that specifically considers sediment drilling and coring operations.

4 DATA EVALUATION AND REPORTING

The data obtained from the additional z-layer sampling will be provided in a data evaluation report that documents the sampling event, collection activities and methods, sample analysis, and data evaluation, and summarizes the field and data quality assurance/quality control procedures. In addition, any deviations from this CQAP Modification No. 1 or the SAP (Anchor QEA 2013e) will be documented in the report.

The data evaluation of the additional z-layer sediment samples will address protectiveness of the backfill material and will include the following components:

- Chemical and physical characteristics of the 0 to -1-foot and -1 to -2-foot (and possibly the -2 to -3-foot) sediment intervals below the post-dredge, pre-backfill surface
- Chemical modeling to assess whether the sediments below the backfill material that may have chemical concentrations above the RvALs are protective of human health and the environment at the applicable points of compliance and exposure media
- Assessment of physical isolation of sediments with total PCBs or metals concentrations above the RvALs from aquatic organisms
- Assessment of backfill stability
- Operational considerations needed to assure backfill stability

The remainder of this section details the objectives and methods to be used for each component of the protectiveness evaluation.

4.1 Protectiveness Evaluation

4.1.1 Z-Layer Characterization

The additional post construction sediment sample results will be used to characterize the condition of the post-dredge, pre-backfill surface along with the depth intervals described above. The evaluation will include the following:

- If the total PCBs and/or metals are below the RvALs in the 0 to -1-foot, and -1 to -2-foot intervals below the post-dredge, pre-backfill surface, then no further evaluation

is necessary. Continue with previously approved long-term monitoring activities detailed in the OMMP, as amended by the pending Addendum No. 1 and 2.

- If the total PCBs and/or metals are above the RvALs in the 0 to -1-foot interval below the post-dredge, pre-backfill surface, but are below the RvALs in the -1 to -2-foot interval, then further protectiveness evaluation is necessary as discussed below.
- If the total PCBs and/or metals are below the RvALs in the 0 to -1-foot interval below the post-dredge, pre-backfill surface, but are above the RvALs in the -1 to -2-foot interval, then further protectiveness evaluation is necessary as discussed below along with a determination of the need to analyze the archived -2 to -3-foot interval sample with EPA.
- If the total PCBs and/or metals are above the RvALs in the 0 to -1-foot interval below the post-dredge, pre-backfill surface interval and above the RvALs in the -1 to -2-foot interval, then further protectiveness evaluation is necessary as discussed below along with a determination of the need to analyze the archived -2 to -3-foot interval sample with EPA.

4.1.2 Further Protectiveness Evaluation

Further protectiveness evaluations will be conducted if the total PCBs and/or metals are above the RvALs in the 0 to -1-foot or the -1 to -2-foot interval below the post-dredge, pre-backfill surface. The further protectiveness evaluations will include the following components.

4.1.2.1 Long-term Filter and Backfill Materials Chemical Modeling

Chemical modeling will be conducted according to procedures outlined in *Guidance for In-Situ Subaqueous Capping of Contaminated Sediments* (Palermo et al. 1998) to simulate the upward migration of PCBs via advection into the filter and backfill material over a 100-year timeframe. Advection is the movement of porewater upward and can occur as a result of compression or consolidation of the sediment underlying the backfill material, or as a result of an upward hydraulic gradient from groundwater flow (Palermo et al. 1998).

The one-dimensional Cap Model developed by Dr. Danny Reible, currently at Texas Tech University, will be used to evaluate whether the filter and backfill material is protective of

surface biota at the applicable points of compliance and exposure media. The modeling will simulate advection of total PCBs upwards through the filter and backfill material over time at each sample station and will estimate the total PCB concentration in the top 10 centimeters (cm) and top 60 cm in the backfill after 100 years.

The modeling will account for the presence of 0.5 percent by weight GAC that functions to decrease PCB concentrations present in the shoreline containment filter material overlying the PDS-1 and PDS-5 sampling stations.

4.1.2.2 Assessment of Physical Isolation

An assessment will be conducted according to procedures described in *Guidance for In-Situ Subaqueous Capping of Contaminated Sediments* (Palermo et al. 1998) to determine if the backfill material physically isolates the contaminants above the RvALs in sediments from benthic or epibenthic organisms. This analysis will consider bioturbation, which is defined as the disturbance and mixing of sediments by benthic organisms, and consolidation. The bioturbation component of the analysis will consider the burrowing depths of the benthic organisms expected to be present in the RAB. In addition, the backfill material consists of a mixture of sand and gravel, and any consolidation of these layers is expected to be minimal.

4.1.2.3 Backfill Stability Assessment

The backfill stability assessment was performed during design (Erosion Analysis, Appendix B to the BODR; Anchor QEA 2013g) to identify material that will remain in place for typical currents in the Lower Duwamish Waterway and provide a suitable habitat material. This assessment will be re-evaluated to confirm that considerations of erosion due to river currents/flow, wind-generated waves, vessel-induced waves, and propeller wash are appropriate, and to identify future verification steps.

4.1.2.4 Operational Considerations

Operational considerations are practices and/or controls that will need to be implemented to assure that the backfill layer remains intact. These considerations will likely relate to navigation activity and will consist of institutional controls that minimize the potential for navigation activity to impact the integrity of the backfill material.

4.2 Data Evaluation Summary and Conclusions

The results of each component described above will be considered together along with results of sampling identified in OMMP Addendum No. 1 (Farallon Consulting in process) and OMMP Addendum No. 2 (Anchor QEA 2015) to determine if the backfill material is currently protective of human health and the environment and if it is expected to remain protective over time.

5 SAMPLING AND EVALUATION SCHEDULE

Below is a proposed schedule for the sampling and evaluation procedures described in this OMMP Addendum No. 2:

- **Submittal of CQAP Modification No. 1**: April 22, 2015
- **Projected EPA Review and Comments to EMJ**: 30 days after receipt of CQAP Modification No. 1
- **EMJ Update and Finalization of Modification No. 1**: 30 days after receipt of EPA's comments on CQAP Modification No. 1
- **Projected EPA Approval**: 30 days after receipt of the finalized CQAP Modification No. 1
- **Sampling**: To be determined after receiving EPA approval of the CQAP Modification No. 1; additional z-layer sampling will occur after the sampling for OMMP Addendum No. 2 is complete and pending contractor availability
- **Data Evaluation and Report Preparation**: CQAP Modification No. 1 data evaluation report submitted 90 days after receipt of final validated analytical results

6 REFERENCES

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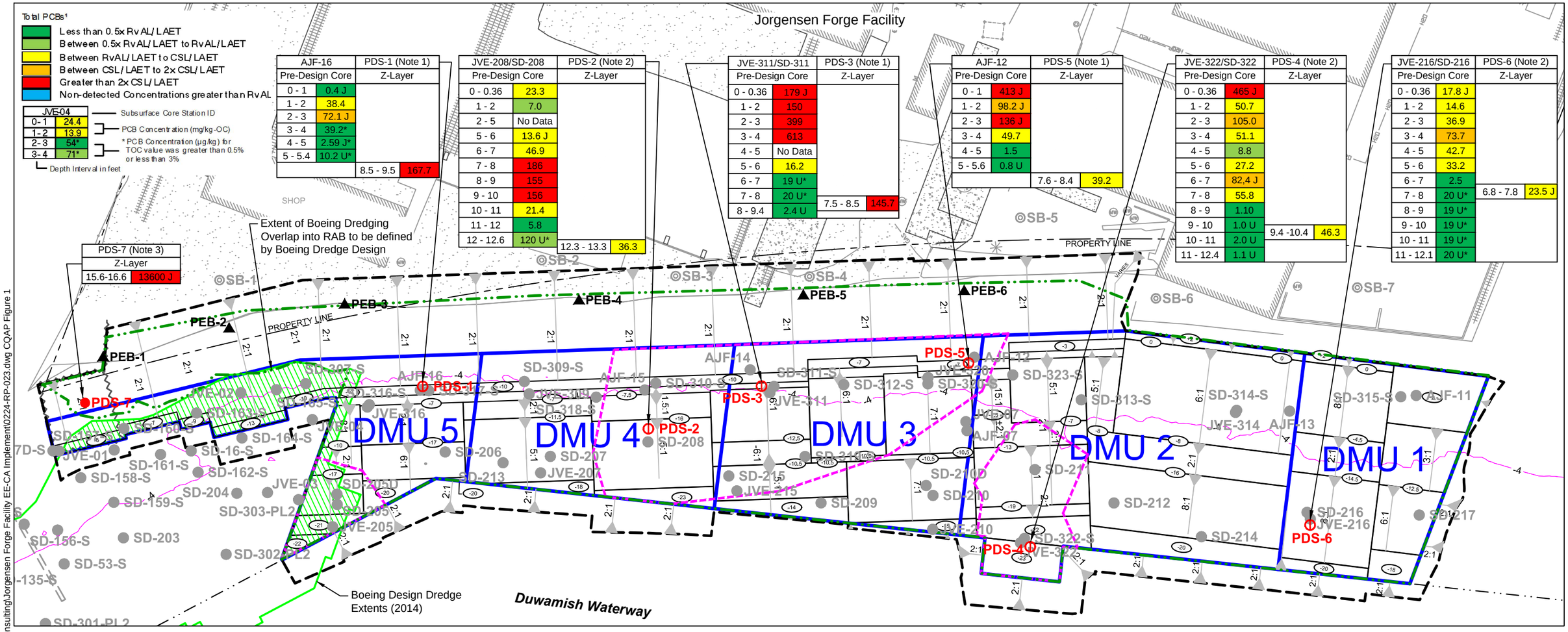
FIGURES



HORIZONTAL DATUM: Washington State Plane North, NAD83.
VERTICAL DATUM: Mean Lower Low Water (MLLW).
NOTES:

1. Sediment z-layer locations PDS-1, PDS-3 and PDS-5 contain 5.4 feet, 6.4 feet and 6.3 feet, respectively, of overlying clean material that contains 0.5 percent by weight granular activated carbon (GAC).
2. Sediment z-layer locations PDS-2, PDS-4 and PDS-6 contain 9.4 feet, 1.9 feet and 8.4 feet, respectively, of overlying clean backfill material.
3. Sediment z-layer location PDS-7 was collected within the in-water containment barrier constructed around sediments impacted by the Jorgensen Forge Outfall Site. This location is overlain by 17.5 feet of clean shoreline containment material that contains 0.5 percent GAC.
4. Removal Action Level (RvAL) = 12 mg/kg-OC.
5. Lower Apparent Effects Threshold (LAET) = 0.13 mg/kg.
6. Cleanup Screening Level (CSL) = 65 mg/kg-OC.
7. Second Lower Apparent Effects Threshold (2LAET) = 1 mg/kg.

LEGEND:

— · · — Navigation Channel

U = Compound analyzed, but not detected above detection limit.

J = Estimated value.

UJ = Compound analyzed, but not detected above estimated detection limit.

OC = Organic carbon.

-13 / -17.5 Required Dredge Elevation (ft MLLW) / Top of Side Slope / Final Grade / Dredge Boundary

Dredge Excavation Boundary

Removal Action Boundary

-4 -4 ft MLLW Elevation Contour

◎SB-1 Existing Soil Boring Sample

● SD-207 Existing Subsurface Sediment Sample

Jorgensen Forge Outfall Site Containment Barrier Wall

Dredge Management Unit (DMU)

Relatively Elevated Total PCB Concentration Area

⦶ PDS-1 Actual Sediment Z-Layer Confirmation Sample

▲PEB-6 Actual Shoreline Bank Z-Layer Confirmation Sample

●PDS-7 Actual Jorgensen Forge Outfall Site Shoreline Bank Z-Layer Confirmation Sample

0 50
Scale in Feet

K:\Projects\0224-Farallon Consulting\Jorgensen Forge Facility EE-CA Implement\0224-RP-023.dwg CQAP Figure 1
Apr 01, 2015 9:29am tgriga

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Figure 1
Summary of Pre-design and Z-layer Sampling Concentrations
Construction Quality Assurance Plan, Modification No. 1
Jorgensen Forge Early Action Area

Existing Boeing Plant 2 2-66 Area Sheetpile Wall

Jorgensen Forge Facility

SHOP

Extent of Boeing Dredging
Overlap into RAB to be defined
by Boeing Dredge Design

PROPERTY LINE

PROPERTY LINE

PDS-7

PDS-1

PDS-2

PDS-3

PDS-5

PDS-6

PDS-4

DMU 5

DMU 4

DMU 3

DMU 2

DMU 1

Boeing Dredge
Extents (2012)

Duwamish Waterway

K:\Projects\0224-Farallon Consulting\Jorgensen Forge Facility EE-CA Implement\0224-RP-027.dwg CQAP Figure 2

Apr 01, 2015 9:33am tgriga

HORIZONTAL DATUM: Washington State Plane North, NAD83.
VERTICAL DATUM: Mean Lower Low Water (MLLW).
NOTES:
1. Post-construction final as-built survey provided by Pacific Pile & Marine and Terrasond dated September 16, 2014.

LEGEND:

- Post-Construction Contours (1 ft interval)
- Dredge Excavation Boundary
- Removal Action Boundary
- -4 ft MLLW Elevation Contour
- Jorgensen Forge Outfall Site Containment Barrier Wall
- Dredge Management Unit (DMU)
- Relatively Elevated Total PCB Concentration Area
- PDS-7 Sediment Z-Layer Confirmation Sample

0 50
Scale in Feet

ANCHOR QEA

Figure 2
Subsurface Z-Layer Sediment Sample Locations
Construction Quality Assurance Plan, Modification No. 1
Jorgensen Forge Early Action Area

APPENDIX A
CORE LOG TEMPLATE

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Sediment Core Collection Log

Job: | **Station ID:**

Job No: | **Attempt No.**

Field Staff: | **Date:**

Contractor: | **Logged By:**

Vertical Datum: | **Horizontal Datum:**

Field Collection Coordinates:

Lat/Northing: | Long/Easting:

A. Water Depth

DTM Depth Sounder:

DTM Lead Line:

B. Water Level Measurements

Time:

Height:

Source:

C. Mudline Elevation

Recovery Measurements (prior to cuts)

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length:

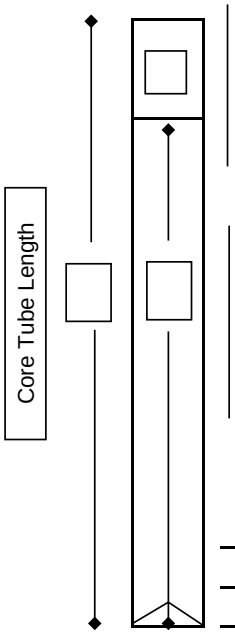
Drive Penetration:

Headspace Measurement:

Recovery Measurement:

Recovery Percentage:

Total Length of Core To Process:



Sections To Process:

A:

B:

C:

D:

Drive Notes:

Core Field Observations and Description:

Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

Sediment Core Processing Log

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Job:	Station ID:
Job No.	Date/Time:
No. of Sections:	Core Logged By:
Drive Length:	Attempt #:
Recovery:	Type of Core ☐ Sonic ☐ Vibracore ☐ Diver Core
% Recovery:	Diameter of Core (inches)
Notes:	Core Quality ☐ Good ☐ Fair ☐ Poor ☐ Disturbed

Recovered Length (ft)	Size % Gravel	Size % Sand	Size % Fines	**Classification and Remarks** (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (ft)	PID	Sample	Summary Sketch